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ABSTRACT

This paper is a report on a study of the effect of charter schools on both students attending them and students in neighboring public schools in Michigan. Using school-level data from Michigan's standardized testing program, the study compared changes in tests scores between charter and public school students. The data included annual math and reading tests for 4th- and 7th-graders, science and writing tests for 5th- and 8th-graders, and a high school proficiency exam for 11th-graders. The paper begins by evaluating the effects of Michigan charter schools on students attending them. The results suggest that charter schools did not have strong effects on the academic achievement of students attending them. The paper then looks at the effects of Michigan charter schools on neighboring public schools. The study used exogenous variation created by Michigan's charter law to identify the effects. The results suggest that charter schools have had little or no effect on test scores in neighboring public schools. (Contains 9 tables of analyzed data and 19 references.) (Author/WFA)

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Eric Bettinger

November 1999

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Occasional Paper No. 4

National Center for the Study of Privatization in Education

Teachers College, Columbia University

The Effect of Charter Schools on Charter Students and Public Schools

Eric Bettinger*

November 1999

Abstract—This paper estimates the effect of charter schools on both students attending them and students at neighboring public schools. Using school-level data from Michigan's standardized testing program, I compare changes in test scores between charter and public school students. I find that test scores of charter school students do not improve, and may actually decline, relative to those of public school students. The paper also exploits exogenous variation created by Michigan's charter law to identify the effects of charter schools on public schools. The results suggest that charter schools have had little or no effect on test scores in neighboring public schools.

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The Occasional Paper Series of the National Center for the Study of Privatization in Education (NCSPE) is designed to promote dialogue about the many facets of privatization in education. The subject matter of the papers is diverse, including research reviews and original research on vouchers, charter schools, home schooling, and educational management organizations. The papers are grounded in a range of disciplinary and methodological approaches. The views presented in these papers are those of the authors and do not necessarily represent the official views of the NCSPE.

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Charter schools are public schools contracted out to the private sector. In 1992, two charter schools operated in the United States, both in St. Paul, Minnesota. By September 1999, almost 300,000 students attended 1,682 charter schools operating in 33 states.[1] Charter advocates, and to some extent the popular press, have argued that charter schools are more innovative and more responsive to students than public schools. They claim that charter schools not only improve educational outcomes of charter students, but that they also improve student outcomes at neighboring public schools through increased competition. This paper evaluates these claims. Using unique data from Michigan, I attempt to measure the effects of charter schools on both the students who attend them and neighboring public schools.

Besides being of immediate policy interest, understanding the impact of charter schools could shed light on a number of broader issues. For example, economists have long been interested in the relationship between school organization and pupil performance (see, e.g., Coleman, Hoffer, and Kilgore 1982, Evans and Schwab 1995, Neal 1997). Since charter schools face fewer state and local regulations than traditional public schools, a study of charter schools may show whether more autonomous public schools can generate higher student achievement. Additionally, economists have studied the effects of competition among schools on student achievement (see, e.g., Hoxby 1994a, Hoxby 1994b, Borland and Howsen 1992). The advent of charter schools appears to have led to significant competition among public schools in some districts,[2] suggesting that charter schools may provide a plausible natural experiment to investigate the effects of competition on student achievement.

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[1] As of September 1999, 38 states have passed laws allowing charter schools.

[2] In Inkster, Michigan, for example, after one-fourth of the school district's enrollment transferred to nearby charter schools, public schools began to offer bicycles and video games to parents who enrolled their children in *public schools.*

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This paper begins by evaluating the effects of Michigan charter schools on students attending them. Prior to 1998, Michigan's annual standardized testing took place in October, shortly after school began. Presumably these tests were administered too early in the school year for charter schools to really have had an effect. Using these "pre-charter" tests, I compare test score gains in charter schools to those in neighboring public schools. Comparisons of gains may provide a better measure of charter performance than comparisons of levels since Michigan charter schools typically attract students who are performing poorly relative to neighboring public schools.

The results suggest that charter schools do not have strong effects on the academic achievement of students attending them. Simple comparisons suggest that academic achievement of charter students, particularly the lowest achieving students, improves more rapidly than in the public schools. However, when I include more flexible specifications that allow for mean reversion, these results disappear. When charter schools are compared to public schools with similar pre-charter characteristics, pupils in charter schools score no higher, on average, and may even be doing worse.

After estimating the effects of charter schools on charter students, I look at the effects of Michigan charter schools on neighboring public schools. Since charter location may be endogenously determined, simple comparisons of public schools near charter schools to those farther away may be biased. To further explore this relationship, I exploit exogenous variation created by Michigan's charter law, which allows state universities to approve charter schools. In particular, state universities where Governor Engler, an avid charter supporter, appoints the boards have approved 150 of Michigan's 170 charter schools. The proximity of a public school to one of these state universities can be used as an instrument for the likelihood that one or more charter schools were established nearby. The resulting instrumental variable (as well as

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the OLS) estimates suggest that charters have had little effect on student achievement in neighboring public schools.

Background

Michigan's Charter Law

Michigan's charter law is perhaps the most permissive law in the country with respect to charter school formation.[3] The first Michigan charter school opened in 1994, and by 1999, 170 charter schools, 10% of all U.S. charter schools, accounted for 3% of Michigan public school enrollment. This section describes Michigan's charter law and explains how the law, coupled with the political environment, create unique, exogenous variation that can be used to identify the effects of charter schools on public schools.[4]

In Michigan, a charter school is a public school run by private entities. Any non-religious group, including existing private and public schools, can apply to open a charter school. To gain approval from an authorizing agency, they must submit a "charter," or contract, which establishes academic goals that the charter school will accomplish during the next seven years. These contracts also specify that if the school does not meet these goals, the authorizing agency may close it. Since 1995, authorizing agencies have closed two charter schools that failed to achieve their goals.

When approved, the charter school receives exemptions from most state/local regulations. For example, the charter school is not obligated to hire unionized teachers, and can have more autonomy than public schools in determining disciplinary policies and school curricula. However, to prevent charter schools from "cream-skimming," or selecting only the best

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[3] Only Arizona has a higher percentage of student enrollment and a higher number of charter schools than Michigan.

[4] Khouri et al. (1999) and Miron and Horn (1999) describe Michigan's charter school law in detail.

students, the law forbids charter schools from discriminating in their enrollment policies. Seventy percent of charter schools are oversubscribed and admit students randomly (Khouri et al. 1999).

Student enrollment completely determines the annual budget of charter schools. Despite this, charter schools still receive substantially less money than public schools. Charter schools receive 97% of the nearly $6000 of state and federal funding allocated for each student, but they receive no local funding, nor do they receive funds to purchase or rent school buildings.

Authorizing agencies receive the other 3% of state per student allowances to compensate them for administrative fees and the costs of monitoring charter schools.[5] As in most states, authorizing boards in Michigan include school districts and intermediate school districts.[6] However, unlike most states, the governing boards of community colleges and state universities may also authorize charter schools.

Allowing universities this power of authorization has been the catalyst for Michigan's rapid charter school growth. Of the 170 charter schools existing in 1999, state universities authorized 150, the maximum number that the law permits them to approve. Of the fifteen state universities, those ten where the governor appoints the boards approved *all* of the university-authorized charter schools. Miron and Horn (1999) argue that allowing state universities to approve charter schools enables Michigan's Governor Engler to exert political pressure. For example, in December 1998, the president of Eastern Michigan University (EMU) announced that EMU would not authorize charter schools. Soon after, the governor threatened EMU with funding cuts, and EMU reversed its policy.

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[5] Monitoring is costly and consequently, most authorizing agencies have not directly profited from charter formation.

[6] Intermediate school districts are county-level organizations that oversee local school districts.

The governor's political pressure, coupled with the costly oversight responsibilities of authorizing agencies, create an exogenous source of variation that this paper uses to identify the effects of charter schools on neighboring public schools. The proximity of a public school to one of the ten universities where the governor appoints the board affects the likelihood that one or more charter schools opens nearby.

Data

The primary outcome of interest in this paper is test scores. The test scores I use are from the Michigan Educational Assessment Program (MEAP), created and normed by the Michigan Department of Education (MDE). The MEAP includes annual math and reading tests for 4th and 7th graders, science and writing tests for 5th and 8th graders, and a high school proficiency exam for 11th graders. The MDE reports the proportion of students at each school scoring "Satisfactory", "Moderate", and "Low" on the MEAP exam (I refer to these school-wide proportions as the "satisfactory rate", the "moderate rate", and the "low rate" respectively). Although these proportions are a coarser measure of student achievement than individual test scores, schools are likely to use these measures to evaluate their progress. For example, these rates are the measures by which the MDE and local media evaluate each school. Additionally, both schools and realtors report these test scores to attract prospective students and clients. The MDE also makes data available on schools' racial composition, enrollment, pupil-teacher ratios, and free/reduced lunch for both charter and public schools from 1993 to 1999.[7]

[7] Scores for the year 1993 refers to the school year 1992-93. Years are always reported as the spring of the academic calendar.

Financial data, including average per student expenditures and average teacher salaries, are also available for each school with a one-year lag.[8]

This paper uses these data to measure the effects of charter schools opening during the 1996-97 school year. Although Michigan's first charter school opened prior to this year, little data is available for charter schools opening before 1996-97. Additionally, starting in the 1997-98 school year, all MEAP testing took place in spring, and as a result, "pre-charter" test scores do not exist for charter schools opening after 1996-97.

Tables 1a and 1b report summary statistics for the math and reading MEAP exams of 4th and 7th graders respectively. The first 3 columns of each table summarize the annual test performance of charter schools starting in the 1996-97 school year. The next 3 columns report summary statistics for public schools located within 5 miles of these charter schools. The final 3 columns summarize test performance for all other Michigan public schools. Panel A reports the distribution of math scores while Panel B reports the distribution of reading scores.

Columns 1, 4, and 7 of Table 1a show the "pre-charter" test score distributions for 4th graders in the respective schools. Comparing Column 1 to Column 4 shows that charter schools had 22 percentage points less of their 4th grade enrollment score in the satisfactory range and 21 percentage points more of their enrollment score in the low range than the public schools. Reading scores in Panel B show a similar pattern. These large, "pre-charter" differences in the test score distributions highlight the fact that charter schools, on average, attract students who are performing much worse on math and reading exams than the neighboring public schools.

By contrast, comparing the "pre-charter" distribution of math and reading scores in the public schools near charter schools (column 4) to those public schools farther away (column 7)

[8] Appendix Table 1 reports descriptive statistics for other school- and district-level covariates used in the

shows little differences, suggesting that charter schools which teach 4th graders do not necessarily open in areas where test performance is low.

The other columns of Table 1a show the test score distributions for charter and public schools after the charter schools had been established for a year or more. In every year, charter school test averages are lower than those of public schools; however, as noted, this is indicative of the students they attract. Consequently, the gain in relative test scores rather than the actual levels may be a better way to measure the effects of charter schools. Comparing the gains in charter school math scores (Columns 1 and 2) to those in public schools (Columns 3 and 4) shows that charter schools were able to increase their satisfactory rate by 6 percentage points more than the public schools nearby. Over the same period, charter schools were able to decrease their low rate by 10 percentage points relative to the public schools. Charters also show more rapid improvement after two years (Columns 3 and 6), in reading scores (Panel B), and in 7th grade math and reading scores (Table 1b). Charter advocates have cited these relative improvements as evidence that charter schools outperform public schools (MAPSA July 2, 1999, *Detroit News* Aug 26, 1999). The next part of this paper evaluates this claim.

The Impact of Charter Schools on Charter Students

This paper uses a number of strategies to identify the effects of charter schools on charter school students. These strategies are similar to those used to evaluate the effects of worker training programs (Ashenfelter 1978, Card and Sullivan 1988).

The first set of results consists of difference-in-differences estimates of the effects of charter schools on charter students. Suppose that a school's educational production function can be represented by

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estimation.

(1) $$E[Y_i \mid j,t] = a_j + \beta_t + \delta C_i$$

where $E[Y_i \mid j,t]$ is the expectation of school i's outcome given that it is of type j (public or private) at time t. a_j represents the average ability of the students choosing to attend school type j, β_t is a time specific effects common to all schools and C_i is an indicator for whether a charter school has existed for an entire year. The effects of charter schools, δ, is identifiable with difference-in-differences techniques:

(2) $$\{E[Y_i \mid j = charter, t = 1998] - E[Y_i \mid j = public, t = 1998]\}$$
$$-\{E[Y_i \mid j = charter, t = 1997] - E[Y_i \mid j = public, t = 1997]\} = \delta.$$

δ can also be computed in a regression using stacked micro data for schools and years. The regression-adjusted version of the difference-in-differences estimator is

(3) $$Y_{it} = \beta_t + \alpha_j + \delta C_{it} + \gamma X_{it} + \varepsilon_{it}$$

where X_{it} are school-level covariates and C_{it} is the product of a dummy variable indicating observations in 1998 and a dummy variable for whether school i is a charter school.

Table 2 shows the difference-in-differences estimates from equation (3). The rows labeled "Diff-in-Diff: Yr 1" and "Diff-in-Diff: Yr 2" are the estimates of the coefficient δ, the effects of charter schools on charter students, after one and two-years respectively. The unit of observation is the school, and the dependent variable is the satisfactory rate on the MEAP. The treatment group includes all charter schools established in the 1996-97 school year while the control group includes public schools within a five-mile radius of the charter school.[9] The standard errors allow for within-district correlation in test scores. All of the regressions are weighted by student enrollment although the results are not sensitive to such weighting.

[9] Although the estimates become weaker as the distance increases, the results are similar when the control groups includes public schools within a 10-, 20-, or 40-mile radii or when the control group includes public schools within the same county (i.e. intermediate school district—see footnote 6).

The results for 4th grade math and reading scores suggest the satisfactory rate has not increased significantly relative to the public schools. Based on the estimated change after one year without controlling for covariates, the satisfactory rate in math increased by 6 percentage points. It declined by 3 percentage points for reading scores relative to the public schools although these changes are imprecisely estimated. These changes are identical to those observed by comparing columns in Table 1a.

After controlling for covariates, the estimated relative change in math scores between charter and public schools is 2.6 percentage points. As above, the estimate is statistically insignificant. The difference-in-differences estimate of the change in the satisfactory rate on the reading exam of charter schools scores relative to the public schools is now much larger (-7.8 percentage points) and marginally significant. The estimated relative changes in test scores are smaller in magnitude when comparing changes after two years; however, these effects are also insignificant for both math and reading scores.

The difference-in-differences estimate for 7th graders are also small and imprecise. Based on comparisons after one year, the percentage of students scoring satisfactory in math increased by 3 percentage points more in the charter schools than in the public schools. The magnitudes of the estimated effects based on comparison after two years are even lower and are similarly imprecise.

Table 2 also reports estimates of the baseline difference between charter and public schools. In panel B, the row enititled "Charter School" estimates the "pre-charter" difference between test scores of charter and public schools. Column 1 does not control for covariates and shows that charter schools had 22% fewer students scoring "Satisfactory" than the public schools. This is the same result found from comparing Columns 1 and 4 of Table 1a. The other

columns in Table 2 show that, even after controlling for covariates, charter schools have a smaller percentage of students scoring satisfactory than their public school counterparts. This is robust across grades and subjects.

The estimates in Table 2 provides no evidence of significant, relative improvements in charter school test scores at the upper-end of the test score distribution. However, charter schools do show relative improvement in reducing the lower-end of the test score distribution. Table 3 reports estimates of the effects of charter schools on percentage of students scoring "Low" on the MEAP exam. The specification is identical to equation (3) except now the dependent variable reports the percentage of students scoring "Low". The columns are similar to Table 2.

For 4th graders, charter school test scores have improved relative to the public schools. Column 2 shows the difference-in-differences estimates for the change in the percentage of charter students scoring low relative to that in the public schools after one year. The low rate declines by 8 percentage points more in the charter schools. When reading scores are compared, the charter schools still show a more rapid decline (-1.1) than the public schools in the percentage of students scoring low, but this result is insignificant. Difference-in-differences estimates based on two-year comparisons are similar for math scores (-7.0) although it is only marginally significant. Charter schools thus show some improvement in the distribution of test scores relative to public schools. Charter schools show improvement in decreasing the low rate rather than increasing the satisfactory rate.

For 7th graders, the difference-in-differences estimates suggest that charter schools also show some improvement in decreasing the low rate relative to public schools. The estimates in Table 2 are consistently negative across subjects and when using different comparison years; however, they are all imprecisely measured.

The causal interpretation of the estimates in Tables 2 and 3 hinge on whether the assumption of a fixed difference between charter schools and public schools is plausible. If charter school attendance is conditional on past performance, however, this assumption would be violated. For example, in the training literature, Ashenfelter (1978) shows that applicants to training programs experienced a dip in their earnings just *prior* to their application. If earnings follow a mean-reverting process, then comparing applicants and non-applicants, without controlling for the earnings dip, will show a spurious, positive effect of the training on participants (Heckman and Robb 1985, Manski 1989). Similarly, the difference-in-differences estimates from Tables 2 and 3 will overstate the effect of charter schools if charters attract students that are *temporarily* performing worse than their public school counterparts. If the likelihood that parents send their children to charter schools is conditional on past performance, comparisons that control for "pre-charter" test scores will give the effect of the intervention (Rubin 1977).

The next set of results, reported in Table 4, consists of regression estimates that control for lagged outcomes. The motivation for this approach is a model where charter status is determined by lagged test scores, instead of permanent school-specific effects. The estimated equation in this case is

$$Y_{it} = \gamma Y_{it-1} + \beta_t + \delta C_{it} + \varepsilon_{it}. \quad (4)$$

As long as the residual is not serially correlated, least-squares will give a consistent estimate of δ, the effects of the charter school conditional on pre-treatment scores.

Column 1 of Table 4 compares 1998-99 math test scores of public and charter school 4th graders, conditional on the 1996-97 test score. Column 2 shows estimates based on comparing 1997-98 test scores. Columns 3 and 4 do the same comparisons for 7th grade math scores. Columns 5-8 show similar results for reading scores. In Panel A, the dependent

variable is the proportion of enrollment scoring satisfactory. In Panel B, the dependent variable is the percentage of students scoring "Low". All of the columns include controls for racial composition and the proportion of the student body on free/reduced lunch.

The estimated effects of charter schools on 4th grade charter students are negative for both math and reading. In column 1 of Panel A, the estimated coefficient implies that the proportion of charter school enrollment that scored satisfactory in math declined by 7 percentage points relative to similar public schools. This effect is marginally significant. After two-years, the estimated effect is larger (10.5 percentage points) and significant. Reading scores show similar results. The proportion of individuals scoring satisfactory is declining by 9-10 percentage points in charter schools relative to public schools with similar pre-charter scores.

Panel B shows similar results. The proportion of individuals scoring low is increasing in charter schools when they are compared to public schools with similar pre-charter test scores. For math scores, this proportion is increasing by 6.7 percentage points after one year and 7.4 percentage points after the second year. These results are statistically significant and suggest that the entire test score distribution in charter schools is shifting downward more rapidly than in public schools with similar "pre-charter" test scores.

The results are less clear for 7th graders. As in the difference-in-differences estimation, the point estimates are extremely small and imprecisely measured. There are also no statistically significant movements in any part of the distribution for math and reading scores of 7th graders, suggesting that charters have had no effect.

These estimates, based on a specification with a lagged dependent variable, have a causal interpretation if charter school attendance is "as good as randomly assigned" conditional on past outcomes. Another method for controlling for past outcomes is a matching estimator (see e.g., Angrist 1998, Dehejia and Wahba 1995; Heckman, Ichimura and Todd 1997). To

implement the matching strategy, I divide the pre-treatment test score into 3 quantiles and make the identifying assumption that within each quantile of pre-charter test scores, charter and public schools are on average comparable.

For each quantile, I estimate equation (7):

$$Y_{it} = \delta_Q C_{it} + \gamma_Q Y_{it-1} + \varepsilon_{it} \tag{7}$$

where if the error term is uncorrelated with whether the school is a charter school, then δ_Q is the effect of the charter schools conditional on being in quantile Q. I construct the population estimate for δ by using the weighted average of the δ_Q's, where the weights are the proportion of treated observations within each quantile:[10]

$$\delta = \sum_q \delta_q P(q = Q \mid j = charter) \tag{8}$$

Intuitively, the matching estimator allows the overall treatment effect to be influenced more by those most likely to be treated.

Table 5 reports these results. Panel A shows the comparisons between charter and public schools based on 3 quantiles of the pre-charter test score. Each row corresponds to the estimation of equation (7) for public and charter schools in a specific quantile. The row entitled "Combined" is the sample equivalent of equation (8) and is interpreted as the effect of charter schools on charter students. In Column 1, the estimated effects of charter schools on 4th grade charter students are negative, but insignificant within each quantile. Charter schools perform worse than public schools within each quantile. The combined result in Column 1 suggests that 5% fewer students score "Satisfactory" in charter schools than in public schools. The negative coefficient is robust across grades and subjects. Charter schools are doing worse within each quantile and overall.

In summary, the difference-in-differences estimates show that charter schools had some improvement relative to the public schools by moving more students from low to moderate scores. The charters were not successful in increasing the proportion of students scoring satisfactory. The difference-in-differences results, however, are not robust to alternative specifications that control for mean reversion. By controlling for pre-charter test scores, these specifications compare charter schools to public schools that are more similar. The estimates from these specifications suggest, particularly for 4th graders, that test scores in the charter schools declined significantly relative to similar public schools.

In estimating the effects of charter school on charter students, an implicit assumption was that charter schools do not affect public schools nearby. The next section investigates the plausibility of this assumption.

The Impact of Charter Schools on the Public Schools

This section estimates the effects of charter schools on neighboring public schools. Besides being of policy interest, these estimates shed light on the interpretation of the estimates in the previous section. Depending on how charter schools affect student achievement in public schools, the estimates from the previous section could be biased upward or downward.

Table 5 reports differences-in-differences estimates of the effects of charter schools on public schools. The estimated equation is

$$Y_{it} = \beta_t + \alpha_i + \delta C_{it} + \gamma X_{it} + \varepsilon_{it}, \quad (9)$$

where C_{it} is the number of charters within a 5-mile radius of public school i at time t. This equation is identical to equation (3), except now I allow the treatment effects to vary linearly with the number of charters.

[10] The matching estimator is described in greater detail in Angrist and Kreuger (1998).

Table 6 reports difference-in-differences estimates for 4th graders.[11] Seventh grade results are similar, although much less precise, and therefore omitted. Columns 1 and 2 estimate the effects of charter schools on public schools' math scores by comparing, after one year, public schools near charter schools to public schools farther away with a basic and full set of covariates. Column 3 includes district fixed-effects. Columns 4-6 are similar except that they estimate the effects of charter schools after two years. Columns 6-12 do the same for reading scores.

In each specification, the estimated effect of charter schools is negative, significant, and small. For example, in Columns 1 and 2, the satisfactory rate in public schools near charters decreased by 0.26 percentage points per charter school relative to other public schools after one year. After two years, the satisfactory rate decreased by 0.59 percentage points per charter schools relative to the other public schools. In public schools near charter schools, schools on average had 2 charter schools within a 5-mile radius. After one year, this implies that public schools near charter schools, on average, had declines of 0.5 and 1.3 percentage points in the math and reading satisfactory rate relative to other public schools. After two years, there were, on average, 3 charter schools. The relative decline in test scores is even greater. These changes in test scores are significant over a 95% confidence interval for math scores after two years and for reading scores after one and two years.

When I estimate similar regressions using the proportion of enrollment scoring low, I get results that are consistent with a downward shift in the distribution of test scores. The lowest end of the distribution becomes larger for both 4th grade math and reading scores.

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[11]Since charter schools attract students who are performing low relative to nearby public schools, nearby public schools should have higher averages already. This will bias all of my coefficients upward in this section.

Table 6 also shows that small but significant pretreatment differences existed between public schools with and without charters. The row "Near Charter School" shows the pre-charter differences between public schools near and away from charters. Public schools near charter schools had satisfactory rates 0.5-1.2 percentage points higher than other public schools. These "pre-charter" differences suggest that public schools near charters were outperforming other public schools. As above, if the "pre-charter" differences reflect *temporary* differences between public schools near charter and other public schools, then the difference-in-differences estimate may overstate the effects of charter schools.

The next set of estimates controls for lagged dependent variables as in equation (4). Table 7 compares test scores in public schools near charter schools to those of other public schools with similar "pre-charter" test scores. The columns labeled "OLS" present estimates based on equation (10) using a sample of public schools after the reform.

$$Y_{it} = \gamma Y_{it-1} + \beta_t + \delta C_{it} + \varepsilon_{it} \tag{10}$$

Equation (10) is identical to equation (4) except that C_{it} is the number of charter schools within a 5-mile radius of the public school i at time t.

In Table 7, the rows entitled "Number of Charters—Yr1" and "Number of Charters—Yr2" report the estimate of δ, the effect of an additional charter school on the proportion of a school scoring satisfactory on the MEAP, after one and two years respectively. For example, in Column 1, each charter school within a five-mile radius increased the proportion of students scoring satisfactory in math by 0.052 percentage points. Since the coefficient is measured imprecisely, it does not provide conclusive evidence of whether charter schools benefit or hurt neighboring public schools. Using a 95% confidence interval, I can, however, estimate the range of possible effects. A 95% confidence interval for the treatment effect in Column 1 is from -.234 to .270. Although the confidence interval does not exclude positive or negative

effects, it suggests that the estimated effect is extremely small, measuring, at the extreme points, less than a 0.02 standard deviation movement in the satisfactory rate for charter schools near public schools.

Column 2 shows the estimates when I include district level fixed effects rather than district level covariates. The estimated coefficient is 0.095 with a standard error of .113. The results in Columns 4 and 5, where the change is measured after two-years of having charter schools located nearby, are similarly small in magnitude. The sign and significance of the estimates in Column 4 and 5 are sensitive to the inclusion of fixed effects.

The "OLS" columns of Table 7 control for spurious mean-reversion effects by comparing schools with similar "pre-charter" test scores. However, if charter location is endogenously determined (e.g., charter schools forming in areas which are always performing poorly), these estimates will also be biased. Columns 3 and 6 therefore report instrumental variables that provide a check on the basic lagged dependent variable specification. Specifically, I use the distance of a public school from a state university where the governor appoints the board as an instrument for the number of charter schools establishing nearby. The first stage for this problem is

$$C_{it} = \theta X_{it} + \phi Z_{it} + \varepsilon_{it} \tag{11}$$

where C is the number of charter schools; Z is the distance from the nearest university where the governor appoints the board; and X are covariates included in Equation (10).

Table 8 reports the first stage results. The first row of the table shows the estimates of the coefficient ϕ from Equation (11). Across columns, the coefficient is always negative, consistent with the idea that schools closer to these state universities are more likely to have charters locate nearby. After one-year, the first-stage relationship is fairly strong, with a coefficient of -.219 and a standard error of .062. The first-stage relationship becomes weaker in

the second year since charter school growth is expanding. In the years leading up to 1998-99, charter schools were located closer to state universities; however, as districts become more saturated with charter schools, universities have begun chartering schools farther away. Given the strong relationship of my instrument in the first year and not the second, my IV estimates after one-year are the more credible estimates.

I report the IV estimates of the effect of charter schools on public schools in Table 7. For both math and reading scores, the estimated relationships are negative and insignificant. For example, in Column 3, each additional charter school causes the proportion of students scoring satisfactory to fall by 0.8 percentage points in nearby public schools. This point estimate is imprecisely measured; however, as above, a 95% confidence interval around this point estimate provides evidence on the magnitude of the effect of charter schools. A 95% confidence interval implies that the effect of charter schools is between –3.0 and 1.5 percentage points. In terms of standard deviations, the effect of charter schools after one year is between –0.2 to 0.1 standard deviations in math and –0.3 and 0.05 standard deviations in reading.

These results contrast to the conclusions presented in Hoxby (1994a). That paper finds that test scores increase in areas where there are a greater number of school districts, concluding that competition improves student achievement. The point estimates in Table 7 do not support this conclusion, but the confidence intervals are not completely inconsistent with it. Furthermore, the confidence intervals around the IV estimates in Hoxby (1994a) are not inconsistent with the point estimates in Table 7. When converted into elasticities, the instrumental variables estimates in Hoxby (1994a) imply a 95% confidence interval for the elasticity of the Herfindahl index to test scores between -0.097 and 0.053 (see Hoxby 1994a; Table 9).[12]

[12] The Herfindahl index is the sum of squared enrollment shares.

What does this imply for Michigan? Figure 1 plots the cumulative percentage change in the Herfindahl index of school enrollment for schools within a five-mile radius of charter schools opening in 1996-97. Remarkably, the Herfindahl index declined by 25% between 1995, when charter schools began forming, and 1999. Using the elasticity implied by Hoxby (1994a), the change in Michigan's Herfindahl index implies that test scores should increase by only 0.44% with a 95 % confidence interval between -1.6% and1.9%. Although the measures of test scores used in this paper and in Hoxby (1994a) are extremely different, the IV estimates in Table 7 are consistent with the confidence intervals in Hoxby's paper. The confidence intervals in both papers cannot reject whether the actual effect of increasing the number of schools is positive or negative; however, the confidence intervals in both papers do show that any potential effect is extremely small and almost negligible.

Conclusion

Using school-level data from Michigan, I find that charter schools do not improve satisfactory rates as rapidly as public schools with similar "pre-charter" test scores. The estimates suggest that 10% fewer students score "Satisfactory" on the MEAP exam relative to similar public schools. The analysis also highlights that charter schools attract students who have lower "pre-charter" test scores than neighboring public schools. On "pre-charter" tests, 21% more of charter school students scored "Low" rather than "Satisfactory" when compared to neighboring public schools.

Despite the fact that public school test scores mechanically increase as charter schools draw away underperforming public school students, test scores still decline in neighboring public schools as the number of charter schools increases. The magnitude of these point estimates, however, is extremely small. For example, the confidence interval suggested by the IV results

in Table 7 suggest that charter schools cause between –0.3 and 0.05 standard deviation movement in the reading scores of neighboring public schools.

The results reported here raise a number of interesting questions. First, why do charter schools have lower academic achievement than public schools? Some possible mechanisms include differences in financial resources, teacher experience, or institutional immaturity. Second, why are the effects of charter schools on student achievement in neighboring public schools so small? As the charter school movement continues to grow, researchers will have more data to estimate these effects more precisely. Future research can also identify the specific mechanisms by which charter schools induce competition. Finally, what are the long-run effects of charter schools? The results in this paper are estimated in the midst of rapid growth and flux of charter schools. The short-run effects may differ substantially from the long-run equilibrium with charter schools. Additionally, once the charter school movement is old enough to generate long-term data, other outcomes, such as dropout rates, college attendance, and future wage and employment status, will also be interesting.

Table 1a. 4th Grade MEAP Scores

	Charter Schools Established in 1996-97 School Year			Public Schools w/i 5 miles of Charter Schools in 1996-97			All Other Public Schools		
	Oct 96 Pre-Charter (1)	Apr 98 Charter Year 1 (2)	Apr 99 Charter Year 2 (3)	Oct 96 Pre-Charter (4)	Apr 98 Charter Year 1 (5)	Apr 99 Charter Year 2 (6)	Oct 96 Pre-Charter (7)	Apr 98 Charter Year 1 (8)	Apr 99 Charter Year 2 (9)
A. MEAP Math Scores:									
% Scoring Satisfactory	34.2	54.2	49.0	56.3	70.0	66.3	54.4	67.6	68.4
	(16.1)	(22.6)	(24.1)	(22.3)	(19.8)	(21.6)	(19.2)	(19.2)	(19.0)
% Scoring Moderate	22.7	24.9	24.7	21.3	19.3	19.3	24.3	21.1	20.3
	(11.2)	(11.8)	(10.8)	(9.2)	(11.2)	(10.4)	(7.4)	(9.5)	(9.2)
% Scoring Low	43.1	21.0	26.3	22.4	10.7	14.4	21.4	11.3	11.3
	(17.2)	(15.5)	(22.8)	(17.3)	(11.4)	(14.1)	(15.6)	(12.3)	(12.0)
B. MEAP Reading Scores:									
% Scoring Satisfactory	34.9	39.8	40.8	47.1	55.3	53.0	43.9	53.5	57.4
	(11.8)	(15.0)	(21.1)	(21.1)	(20.1)	(19.9)	(15.8)	(17.0)	(15.9)
% Scoring Moderate	28.4	33.9	30.5	28.5	26.4	27.8	31.0	27.0	25.6
	(9.8)	(10.6)	(11.7)	(10.0)	(10.8)	(9.8)	(7.2)	(7.7)	(6.8)
% Scoring Low	36.7	26.3	28.8	24.4	18.3	19.1	25.1	19.5	17.1
	(13.3)	(14.2)	(19.7)	(15.5)	(13.2)	(14.4)	(12.8)	(12.8)	(11.8)
N	33	32	31	552	546	546	2115	2139	2149

Notes: Unit of observation is the school. Standard deviations are in parentheses. Weighted by the number of students taking the exam.

Table 1b. 7th Grade MEAP Scores

	Charter Schools Established in 1996-97 School Year			Public Schools w/i 5 miles of Charter Schools in 1996-97			All Other Public Schools		
	Oct 96 Pre-Charter (1)	Apr 98 Charter Year 1 (2)	Apr 99 Charter Year 2 (3)	Oct 96 Pre-Charter (4)	Apr 98 Charter Year 1 (5)	Apr 99 Charter Year 2 (6)	Oct 96 Pre-Charter (7)	Apr 98 Charter Year 1 (8)	Apr 99 Charter Year 2 (9)
A. MEAP Math Scores:									
% Scoring Satisfactory	28.9	39.6	36.4	43.6	52.6	54.7	56.2	70.3	70.2
	(24.3)	(22.6)	(25.0)	(22.4)	(23.3)	(23.8)	(18.7)	(17.5)	(17.8)
% Scoring Moderate	24.9	29.5	27.3	26.8	26.7	25.5	23.5	20.0	19.3
	(12.8)	(9.8)	(10.0)	(7.8)	(9.4)	(9.6)	(7.7)	(9.5)	(9.1)
% Scoring Low	46.2	30.9	36.3	29.6	20.7	19.7	20.3	9.7	10.5
	(26.1)	(20.8)	(23.1)	(20.3)	(17.2)	(16.7)	(14.7)	(10.5)	(11.1)
B. MEAP Reading Scores:									
% Scoring Satisfactory	25.2	35.9	34.1	36.3	43.4	47.2	45.5	55.3	58.2
	(17.3)	(19.3)	(22.6)	(17.1)	(19.0)	(18.8)	(16.2)	(16.7)	(15.8)
% Scoring Moderate	33.3	30.6	30.7	32.5	28.4	27.8	30.4	26.7	25.6
	(12.3)	(7.9)	(11.0)	(6.5)	(6.9)	(7.0)	(7.8)	(8.3)	(7.4)
% Scoring Low	41.5	33.5	35.2	31.2	28.2	24.9	24.2	18.0	16.2
	(20.2)	(18.7)	(17.0)	(15.7)	(15.6)	(14.9)	(12.5)	(11.8)	(11.4)
N	19	18	18	182	178	177	2485	2509	2517

Notes: Unit of observation is the school. Standard deviations are in parentheses. Weighted by the number of students taking the exam.

Table 2. Difference-in-Difference Estimates of the Effect of Charter Schools on Charter Students
Dependent Variable = % Scoring Satisfactory

	Math Scores					Reading Scores				
	Grade 4 w/o covars	Grade 4 w/ covars	Grade 4 w/ covars	Grade 7 w/ covars	Grade 7 w/ covars	Grade 4 w/o covars	Grade 4 w/ covars	Grade 4 w/ covars	Grade 7 w/ covars	Grade 7 w/ covars
A. Treatment Effects										
Diff-in-Diff: Yr 1	6.3	2.6		3.2		-3.2	-7.8		4.4	
	(5.3)	(5.3)		(4.8)		(3.5)	(4.1)		(3.6)	
Diff-in-Diff: Yr 2			1.9		-.212			-4.1		.008
			(5.2)		(6.7)			(5.0)		(5.9)
B. Main Effects										
Charter School	-22.1	-15.9	-16.9	-13.9	-11.6	-12.3	-6.3	-6.7	-10.0	-6.3
	(4.3)	(5.7)	(5.0)	(8.3)	(9.2)	(2.8)	(5.0)	(5.4)	(6.9)	(7.4)
Post Year 1	13.7	13.5		8.4		8.2	7.9		6.7	
	(1.0)	(1.0)		(1.9)		(.890)	(.916)		(2.0)	
Post Year 2			10.0		10.2			5.5		10.1
			(.716)		(1.6)			(2.9)		(2.3)
C. Covariates										
% Black		-.027	-.049	-.089	-.059		.078	.045	.003	-.022
		(.028)	(.034)	(.038)	(.034)		(.027)	(.019)	(.033)	(.030)
% Hispanic		-.186	-.235	-.040	-.063		-.101	-.119	.037	-.022
		(.092)	(.100)	(.128)	(.126)		(.095)	(.080)	(.088)	(.077)
% Free & Reduced		-.279	-.284	-.453	-.490		-.340	-.371	-.403	-.376
Lunch		(.064)	(.071)	(.077)	(.076)		(.081)	(.059)	(.083)	(.085)
R^2	.11	.29	.27	.49	.48	.05	.20	.24	.40	.44
N	1163	1163	1161	396	395	1163	1163	1161	397	396

Notes: Unit of observation is the school. Standard errors are corrected for correlation within districts. Weighted by the number of students taking the exam. Treatment group includes charter schools opening in the 1996-97 school year. Control group includes all public schools in a 5-mile radius of the treatment group.

Table 3. Difference-in-Difference Estimates of the Effect of Charter Schools on Charter Students
Dependent Variable = % Scoring *Low*

	Math Scores					Reading Scores				
	Grade 4 w/o covars	Grade 4 w/ covars	Grade 4 w/ covars	Grade 7 w/ covars	Grade 7 w/ covars	Grade 4 w/o covars	Grade 4 w/ covars	Grade 4 w/ covars	Grade 7 w/ covars	Grade 7 w/ covars
A. Treatment Effects										
Diff-in-Diff: Yr 1	-10.5	-8.4		-7.6		-4.3	-1.1		-5.6	
	(4.0)	(4.0)		(6.6)		(3.7)	(4.3)		(3.8)	
Diff-in-Diff: Yr 2			-7.0		-3.4			.149		-2.0
			(4.5)		(6.9)			(4.7)		(5.7)
B. Main Effects										
Charter School	20.7	16.9	16.9	15.8	15.2	12.3	8.1	8.5	8.2	5.6
	(4.2)	(4.7)	(4.9)	(8.9)	(9.6)	(3.2)	(5.6)	(5.9)	(7.8)	(8.0)
R^2	.16	.33	.30	.49	.49	.06	.23	.26	.38	.38
N	1163	1163	1161	396	395	1163	1163	1161	397	396

Notes: Unit of observation is the school. Standard errors are corrected for correlation within districts. Weighted by the number of students taking the exam. Treatment group includes charter schools opening in the 1996-97 school year. Control group includes all public schools in a 5-mile radius of the treatment group. The regressions also include fixed effects for time and controls for percentage of enrollment that is black, percentage of enrollment that is Hispanic, and percentage of enrollment that is on free/reduced lunch.

Table 4. Estimates of the Effect of Charter Schools on Charter Students – Controlling for Lagged Dependent Variable

	Math Scores				Reading Scores			
	Grade 4 1998	Grade 4 1999	Grade 7 1998	Grade 7 1999	Grade 4 1998	Grade 4 1999	Grade 7 1998	Grade 7 1999
A. Dependent Variable is % Scoring Satisfactory								
Charter School	-6.9	-10.5	-1.3	-.578	-9.9	-8.9	-1.3	.334
	(4.1)	(3.4)	(2.8)	(4.2)	(3.0)	(4.1)	(2.5)	(2.9)
1996-97 % Scoring	.482	.404	.634	.597	.489	.384	.714	.585
Satisfactory	(.045)	(.022)	(.030)	(.036)	(.030)	(.026)	(.026)	(.033)
R^2	.44	.39	.75	.68	.42	.49	.73	.67
B. Dependent Variable is % Scoring Low								
Charter School	6.7	7.4	1.7	6.2	3.5	6.6	-.216	-.249
	(3.3)	(4.3)	(4.1)	(4.3)	(2.2)	(3.2)	(3.2)	(2.7)
1996-97 % Scoring	-.220	-.226	-.404	-.307	-.275	-.240	-.529	-.437
Satisfactory	(.041)	(.018)	(.057)	(.041)	(.024)	(.020)	(.035)	(.050)
R^2	.35	.35	.67	.60	.40	.44	.68	.59
N	578	576	195	194	578	576	195	195

Notes: Unit of observation is the school. Standard errors are corrected for correlation within districts. Weighted by the number of students taking the exam. Treatment group includes charter schools opening in the 1996-97 school year. Control group includes all public schools in a 5-mile radius of the treatment group. The regressions also include fixed effects for time and controls for percentage of enrollment that is black, percentage of enrollment that is Hispanic, and percentage of enrollment that is on free/reduced lunch.

Table 5. Lagged Dependent Variable Specifications on Charter Students – Matching by Quantile
Dependent Variable=% Scoring Satisfactory

	Math Scores				Reading Scores			
	Grade 4	Num Trt	Grade 7	Num Trt	Grade 4	Num Trt	Grade 7	Num Trt
Charter Schools in 1997-98								
Quantile: I	-2.5	21	7.0	8	-10.3	13	1.8	8
	(6.5)		(7.6)		(6.3)		(5.5)	
II	-5.3	8	-2.1	4	-9.8	17	-4.3	6
	(9.1)		(11.6)		(5.9)		(9.9)	
III	-26.5	2	-17.5	5	-6.6	2	-17.2	4
	(8.7)		(13.7)		(10.7)		(17.5)	
Combined	-4.8	31	-2.4	17	-9.8	32	-4.5	18
	(5.0)		(6.1)		(4.1)		(5.7)	
Charter Schools in 1998-99								
Quantile: I	-6.4	22	6.2	8	-11.3	14	2.8	8
	(6.4)		(10.0)		(5.9)		(7.3)	
II	-6.5	6	-8.3	5	3.7	16	-11.0	6
	(9.6)		(11.9)		(5.2)		(9.2)	
III	-41.6	2	-23.2	5	-7.8	1	-12.5	4
	(10.9)		(14.7)		(15.1)		(18.6)	
Combined	-8.8	30	-6.0	18	-3.4	31	-5.2	18
	(5.1)		(6.9)		(3.8)		(6.1)	

Notes: Unit of observation is the school. Treatment group includes charter schools opening in the 1996-97 school year. Control group includes all public schools in a 5-mile radius of the treatment group. The regressions also include controls for percentage of enrollment that is black, percentage of enrollment that is Hispanic, and percentage of enrollment that is on free/reduced lunch. The combined coefficient is a weighted average of the quantile estimates, weighted by the number of treatment observations. Standard errors are not corrected since the small number of treated observations in the upper quartiles does not justify the use of asymptotic corrections, such as White standard errors or clustering.

Table 6. Difference-in-Difference Estimates of the Effect of Charter Schools on 4th Graders in Public Schools
Dependent Variable = % Scoring Satisfactory

	Math Scores						Reading Scores					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
A. Treatment Effects												
Diff-in-Diff: Number of Charters Yr 1	-.264	-.259	-.322				-.684	-.692	-.609			
	(.192)	(.172)	(.166)				(.130)	(.137)	(.136)			
Diff-in-Diff: Number of Charters Yr 2				-.594	-.554	-.705				-1.2	-1.2	-1.2
				(.186)	(.199)	(.139)				(.277)	(.290)	(.287)
B. Main Effects												
Near Charter School	.528	.530	.618	.746	.710	.839	.787	.811	.510	1.1	1.2	.942
	(.260)	(.265)	(.171)	(.264)	(.281)	(.171)	(.266)	(.270)	(.243)	(.319)	(.326)	(.327)
Post Year 1	13.6	13.6	13.7				10.3	10.3	10.4			
	(.403)	(.390)	(.415)				(.542)	(.495)	(.482)			
Post Year 2				12.1	12.1	12.5				12.5	12.5	12.9
				(.541)	(.499)	(.510)				(.968)	(.883)	(.861)
District FE	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
C. Covariates												
% Black	-.023	-.100	-.172	-.055	-.126	-.227	.076	-.043	-.123	.012	-.077	-.176
	(.025)	(.027)	(.023)	(.025)	(.029)	(.024)	(.030)	(.027)	(.028)	(.028)	(.025)	(.026)
% Hispanic	-.106	-.180	-.288	-.175	-.255	-.406	-.060	-.154	-.217	-.130	-.204	-.285
	(.084)	(.083)	(.046)	(.086)	(.086)	(.059)	(.086)	(.074)	(.056)	(.074)	(.065)	(.043)
% Free & Reduced Lunch	-.372	-.268	-.223	-.370	-.260	-.214	-.422	-.324	-.284	-.396	-.310	-.275
	(.034)	(.034)	(.037)	(.037)	(.036)	(.043)	(.039)	(.036)	(.049)	(.030)	(.023)	(.032)
% Urban Pop in District		.001			.004			-.003			-.009	
		(.013)			(.012)			(.012)			(.010)	
Ln(median income per capita) in District		7.4			5.7			5.5			4.0	
		(3.2)			(3.4)			(3.6)			(3.1)	
Unemployment Rate in 1990		.671			.532			1.1			.813	
		(.297)			(.270)			(.347)			(.313)	
% Pop in District w/ some college		.210			.230			.351			.310	
		(.055)			(.058)			(.058)			(.053)	
R^2	.39	.41	.60	.39	.41	.59	.32	.36	.56	.39	.42	.57
N	3690	3690	3690	3699	3699	3699	3690	3690	3690	3699	3699	3699

Notes: Unit of observation is the school. Standard errors are corrected for correlation within districts. Weighted by the number of students taking the exam. Treatment group includes public schools within 5-miles of a charter school. Control group includes all other public schools in the state.

Table 7. Lagged Dependent Variable and IV Specifications
of the Effect of Charter Schools on 4th Graders in Public Schools
Dependent Variable = % Scoring Satisfactory

	Math Scores						Reading Scores					
	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) OLS	(6) IV	(7) OLS	(8) OLS	(9) IV	(10) OLS	(11) OLS	(12) IV
A. Treatment Effects												
Number of Charters-Yr1	.052	.095	-.789				.082	.033	-1.5			
	(.109)	(.113)	(1.1)				(.095)	(.157)	(1.2)			
Number of Charters Yr 2				-.009	.303	-1.9				.085	.430	-1.6
				(.124)	(.084)	(2.9)				(.131)	(.044)	(2.8)
C. Covariates												
1996-7 Satisfactory Rate	.494	.428	.434	.560	.365	.405	.436	.404	.408	.364	.316	.337
	(.025)	(.071)	(.038)	(.020)	(.028)	(.075)	(.022)	(.060)	(.042)	(.017)	(.04.)	(.049)
% Urban Pop in District	Yes			Yes			Yes			Yes		
Ln(median income per capita) in District	Yes			Yes			Yes			Yes		
Unemployment Rate in 1990	Yes			Yes			Yes			Yes		
% Pop in District w/ some college	Yes			Yes			Yes			Yes		
District FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
R^2	.52	.67	--	.50	.65	--	.51	.66	--	.57	.69	--
N	1816	1816	1816	1805	1805	1805	1805	1808	1808	1797	1797	1797

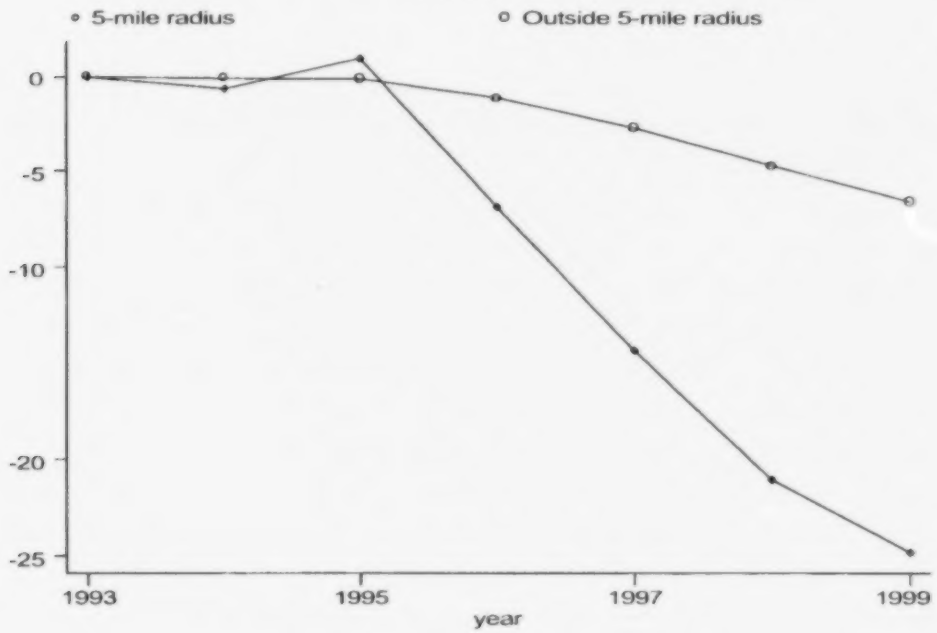
Notes: Unit of observation is the school. Standard errors are corrected for correlation within districts. Weighted by the number of students taking the exam. Treatment group includes public schools within 5-miles of a charter school. Control group includes all other public schools in the state. The regressions also include fixed effects for time and controls for percentage of enrollment that is black, percentage of enrollment that is Hispanic, and percentage of enrollment that is on free/reduced lunch.

Table 8. First-stage Regressions Predicting the Number of Charter Schools
Dependent Variable = Number of Charter Schools w/I 5 Miles

	Math Scores Sample		Reading Scores Sample	
	(1)	(2)	(3)	(4)
	1997-98	1998-99	1997-98	1998-99
Minimum Distance From State University where Gov appoints	-.219	-.111	-.219	-.106
	(.062)	(.091)	(.061)	(.091)
1996-7 Satisfactory Rate	.007	.018	.001	.010
	(.008)	(.013)	(.008)	(.013)
% Black	.034	.042	.033	.041
	(.008)	(.010)	(.008)	(.010)
% Hispanic	.021	.070	.020	.067
	(.016)	(.018)	(.016)	(.017)
% Free & Reduced Lunch	-.008	-.010	-.009	-.012
	(.009)	(.014)	(.009)	(.014)
District FE	Yes	Yes	Yes	Yes
R^2	.81	.82	.81	.82
N	1816	1805	1808	1797

Notes: Unit of observation is the school. White standard errors are reported. Weighted by the number of students taking the exam. Treatment group includes public schools within 5-miles of a charter school. Control group includes all other public schools in the state.

Figure 1. Cumulative Percentage Change in the Herfindahl Index Of School Enrollment Within and Outside of a 5-Mile Radius of Charter Schools that Opened in 1996-97



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Appendix Table 1. Additional Descriptive Statistics for Elementary Schools

	Charter Schools Opening in 1996-97	Public Schools w/i 5 miles of Charter Schools in 1996-97	Other Public Schools
A. School-Level Covariates, 1996-97			
% Black	30.1	30.6	6.8
	(38.2)	(41.2)	(18.8)
% Hispanic	5.2	2.9	1.9
	(13.2)	(8.6)	(3.9)
% Free & Reduced Lunch	57.2	51.2	30.1
	(20.7)	(29.1)	(22.2)
B. District-Level Covariates, 1990			
% Urban Pop in District	67.1	90.1	54.0
	(46.8)	(27.7)	(46.5)
Ln(median income per capita) in	10.2	10.1	10.3
District	(0.3)	(0.3)	(0.4)
Unemployment Rate in 1990	9.5	14.0	9.2
	(5.5)	(6.9)	(5.5)
% Pop in District w/ some college	46.1	40.9	43.7
	(12.0)	(12.2)	(13.0)
N	33	590	1321

Notes: Unit of observation is the school. Standard deviations are in parentheses. Weighted by the number of students taking mathematics exam.

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